CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

1. A magnetic resonance imaging apparatus comprising:

a means **(10, 44, 46, 50, 52)** for acquiring radial readout lines of magnetic resonance imaging data;

a means **(58)** for reconstructing the acquired readout lines into reconstructed image data; and

a means **(134, 140)** for coordinating a direction of a radial readout line with a displacement of a feature of interest, the coordinating means **(134, 140)** biasing at least one of the acquiring means **(10, 44, 46, 50, 52)** and the reconstructing means **(58)** toward a selected relationship between readout magnetic field gradient direction and the displacement of the feature of interest.

2. The magnetic resonance imaging apparatus as set forth in claim **1**, further including:

a means **(120, 122, 124, 126, 130)** for determining the displacement of the feature of interest.

3. The magnetic resonance imaging apparatus as set forth in claim **2**, wherein the determining means **(120, 122, 124, 126, 130)** is selected from a group consisting of:

a means **(122, 124, 126)** for measuring a physiological parameter correlated with displacement of the feature of interest, the displacement being determined based on the measured physiological parameter,

a means **(130)** for extracting a position of the feature of interest from magnetic resonance imaging data acquired by the acquiring means **(10, 44, 46, 50, 52)**, the displacement being determined as displacement of the position of the feature of interest from a reference position, and

a magnetic resonance navigator **(130)** cooperating with the acquiring means **(10, 44, 46, 50, 52)**.

4. The magnetic resonance imaging apparatus as set forth in claim **1**, wherein the coordinating means **(134, 140)** includes:

a means **(134, 140)** for biasing the radial readout lines toward orienting the readout magnetic field gradient direction transverse to the displacement.

5. The magnetic resonance imaging apparatus as set forth in claim **4**, wherein the coordinating means **(134, 140)** further includes:

a means **(134)** for computing an acquisition order **(136)** of radial readout lines, the acquisition order **(136)** being biased by the biasing means **(134)** toward orienting the readout magnetic field gradient direction transverse to the displacement, the acquiring means **(10, 44, 46, 50, 52)** acquiring the readout lines of magnetic resonance imaging data in the acquisition order **(136)**.

6. The magnetic resonance imaging apparatus as set forth in claim **4**, wherein the coordinating means **(134)** operates substantially concurrently with the acquiring means **(10, 44, 46, 50, 52)**, the coordinating means **(134)** selecting a readout magnetic field gradient direction **(136)** of a next readout line acquisition based on a present displacement of the feature of interest.

7. The magnetic resonance imaging apparatus as set forth in claim **4**, wherein the coordinating means **(134, 140)** further includes:

a means **(140)** for selecting a dataset of acquired readout lines that is a sub-set of the acquired readout lines, the selecting being biased by the biasing means **(140)** toward selecting readout lines for which the readout magnetic field gradient direction is generally transverse to the displacement, the reconstructing means **(58)** reconstructing the dataset of acquired readout lines into reconstructed image data.

8. The magnetic resonance imaging apparatus as set forth in claim **1**, wherein the coordinating means **(134, 140)** includes:

a means **(134, 140)** for selecting an ordering of radial readout lines for which an angle between the readout magnetic field gradient direction and the displacement varies smoothly.

9. The magnetic resonance imaging apparatus as set forth in claim **8**, wherein the coordinating means **(134, 140)** further includes at least one of:

a means **(134)** for controlling the acquiring means to acquire readout lines of magnetic resonance imaging data having the selected ordering, and

a means **(140)** for selecting a dataset of acquired readout lines that is a sub-set of the acquired readout lines, the dataset having the selected ordering, the reconstructing means **(58)** reconstructing the dataset of acquired readout lines into reconstructed image data.

10. The magnetic resonance imaging apparatus as set forth in claim **1**, wherein the coordinating means **(134, 140)** includes:

a means **(134)** for determining an optimized ordering **(136)** of a set of readout lines based on a cyclic displacement trajectory, the acquiring means **(10, 44, 46, 50, 52)** acquiring the radial readout lines of magnetic resonance imaging data using the optimized ordering **(136)**.

11. The magnetic resonance imaging apparatus as set forth in claim **10**, wherein the means **(134)** for determining an optimized ordering **(136)** includes:

an optimizing means **(134)** for optimizing the ordering of the set of readout lines to minimize a figure of merit indicative of the selected relationship between readout magnetic field gradient direction and the determined displacement of the feature of interest.

12. A magnetic resonance imaging method comprising:

determining a displacement of a feature of interest;

selecting a direction of a radial readout line based on the determined displacement;

acquiring a radial readout line of magnetic resonance imaging data using a readout magnetic field gradient having the selected direction;

repeating the determining, selecting, and acquiring to collect a dataset of radial readout lines; and

reconstructing the dataset of radial readout lines into reconstructed image data.

13. The magnetic resonance imaging method as set forth in claim **12**, wherein the selecting of a direction includes at least one of:

biasing the direction toward orienting the radial readout line direction generally transverse to the displacement,

biasing more strongly for large displacements, and

selecting the direction such that an angle between the direction and the displacement of the feature of interest varies smoothly.

14. The magnetic resonance imaging method as set forth in claim **12**, wherein the determining of a displacement of a feature of interest is repeated to determine a cyclic displacement of the feature of interest, and the selecting of a direction of a radial readout line based on the determined displacement includes:

optimizing an ordering of a set of readout lines with respect to the cyclic displacement of the feature of interest, the acquiring of a radial readout line of magnetic resonance imaging data including acquiring a plurality of readout lines in the selected ordering.

15. The magnetic resonance imaging method as set forth in claim **14**, wherein the optimizing of the ordering is such that when the displacement of the feature of interest is large the acquired radial readout line has a direction selected substantially orthogonal to the large displacement.

16. The magnetic resonance imaging method as set forth in claim **12**, wherein the determining of a displacement of a feature of interest is repeated to determine a cyclic displacement of the feature of interest, and the selecting of a direction of a radial readout line based on the determined displacement includes:

selecting a sub-set of the acquired radial readout lines based on an angle between the readout line and the displacement of the feature of interest at the time the readout line was acquired, the reconstructing being performed on the selected sub-set.

17. The magnetic resonance imaging method as set forth in claim **16**, wherein the selecting of a sub-set uses a criterion selected from a group consisting of:

selecting a sub-set biased toward a 90° angle between readout magnetic field gradient direction and displacement of the feature of interest, and

selecting a sub-set in which the angle between the readout line and the displacement of the feature of interest varies smoothly.

18. The magnetic resonance imaging method as set forth in claim 12, wherein the determining of a displacement of a feature of interest includes one of:

measuring a physiological parameter correlated with displacement of the feature of interest, the displacement being determined based on the measured physiological parameter,

extracting a position of the feature of interest from acquired magnetic resonance images, the displacement being determined as displacement of the position of the feature of interest from a reference position, and

acquiring magnetic resonance echoes interspersed among the imaging echoes to determine the displacement of the feature of interest.

19. A magnetic resonance imaging apparatus comprising:

a main magnet **(20)**;

magnetic field gradient coils **(30)**;

a radio frequency coil **(32)**;

a processor **(134, 140)** for performing the method of claim **12**; and

a reconstruction processor **(58)**.

20. A magnetic resonance imaging apparatus comprising:

a sensor **(120, 122, 124, 126, 130)** measuring a displacement of a feature of interest;

a magnetic resonance imaging scanner **(10)** acquiring radial readout lines of magnetic resonance imaging data;

a reconstruction processor **(58)** reconstructing the acquired readout lines into reconstructed image data; and

a coordinating processor **(134, 140)** coordinating a direction of a radial readout line with the determined displacement, the coordinating processor **(134, 140)** biasing at least one of the magnetic resonance imaging scanner **(10)** and the reconstruction processor **(58)** toward a selected relationship between readout magnetic field gradient direction and the determined displacement of the feature of interest.